U. S. FOREST SERVICE

RESEARCH NOTE NC-124

NORTH CENTRAL FOREST EXPERIMENT STATION, FOREST SERVICE—U.S. DEPARTMENT OF AGRICULTURE

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CROWN RELEASE PROMOTES FASTER DIAMETER GROWTH OF POLE-SIZE BLACK WALNUT

ABSTRACT. — Complete crown release more than doubled the diameter growth of pole-size black walnut trees in southern Indiana over a 10-year period. Partially released trees grew about 50 percent more than unreleased trees. The faster growth of the released trees was directly related to increases in crown-area expansion. Most of the study trees produced bole sprouts; however, the incidence of sprouting was higher and the sprouts were larger on the completely released trees than on the unreleased trees. Controlling understory growth during the last 6 years of the study had no significant effect on growth of the walnut trees.

OXFORD: 242:561.21:181.63:176.1 *Juglans nigra* (772). KEY WORDS: understory control, crown growth, bole sprouting.

Most of the naturally established black walnut trees in this country are found growing isolated or in small groups mixed with other hardwoods. To obtain the best growth on such trees, side competition may have to be removed by release, thinning, or weeding. Because such practices usually require an initial cash investment by the landowner, it is important to know how much and for how long growth will be improved. The study reported here showed that providing adequate crown release to pole-size black walnut trees in southern Indiana stimulated growth for at least 8 years; this growth increase was maintained 2 more years by additional release, and the growth trends are expected to continue for several more years. Bole sprouting lowered the quality of the released and unreleased trees to some extent, but this problem could be corrected by pruning.

WHAT WE DID

The study was conducted on the Paoli Experimental Forest in southern Indiana. The pole-size walnut study trees are scattered throughout a mixed hardwood stand on north and east slopes; the soils have been derived from relatively uniform sandstone and shales. When the study was started in 1959, the walnut trees were about 45 years old, 6 to 12 inches d.b.h., and 50 to 80 feet tall. Fifty-four trees were selected for study. They were divided into 18 groups of 3 trees that were close together and similar in age, crown diameter, crown position, and size.

During the winter of 1959-1960, one tree in each group was given "complete" crown release, one was given partial crown release, and one was left undisturbed. Enough competing trees were removed around completely released trees so that at least three of the four sides of the crown were free-growing (fig. 1.). For partially released trees, we left at least two sides of the crown free-growing. A side of a study tree was considered free to grow when crowns of adjacent trees 60 to 100 percent as tall were at least 5 feet and crowns of taller trees were at least 10 feet from the crown

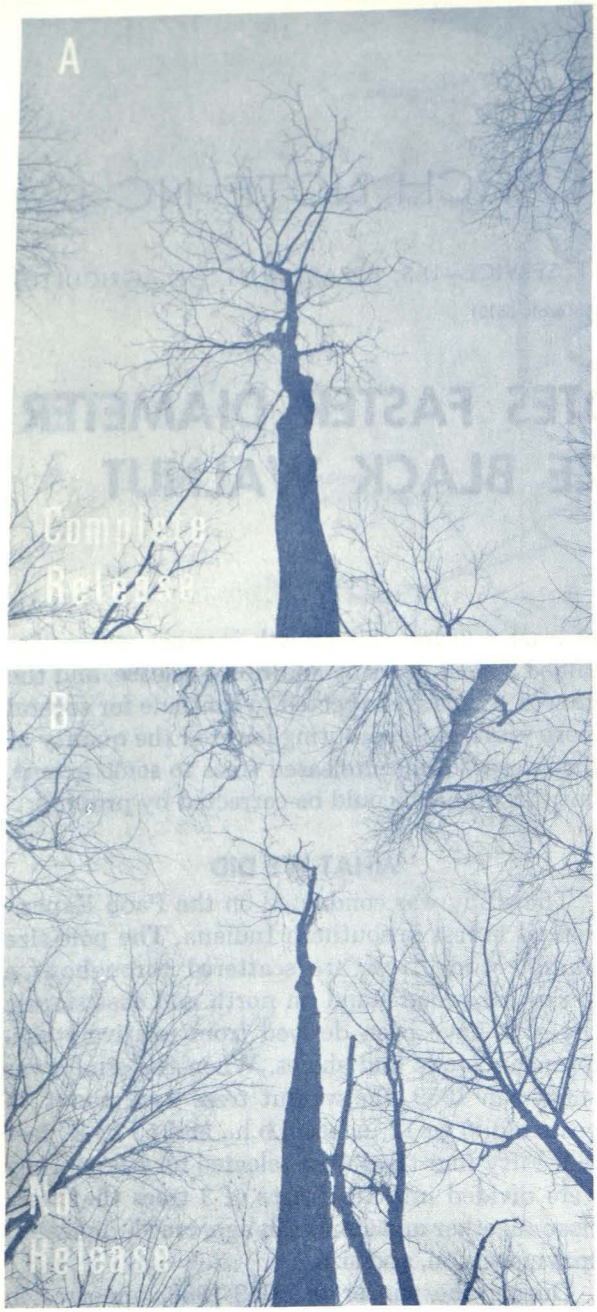

Figure 1. — Crowns of completely released trees (A) had much more growing space and were much larger than crowns of unreleased trees (B) after 10 years.

of the study tree. Because of rapid crown expansion following release, the study trees were released again in 1968. Only a few treees had to be removed in this second treatment to attain the same degree of release as in 1959.

In 1964, the effect of removing understory competition on tree growth was tested. All understory vegetation around half of the study trees in each release treatment was cut and herbicided in a circle extending out to the edge of surrounding tree crowns. The vegetation in this circular area was retreated annually to prevent regrowth.

Detailed measurements were taken on various bole and crown dimensions when the study was started in 1959, and again in 1969. D.b.h. was measured periodically during the 10-year period to determine diameter-growth trends.

WHAT HAPPENED

The trees responded quickly to the crown release — within 2 years[1] after the initial treatments, the completely released trees were growing almost twice as fast as the unreleased trees (fig. 2). This difference in diameter growth rate

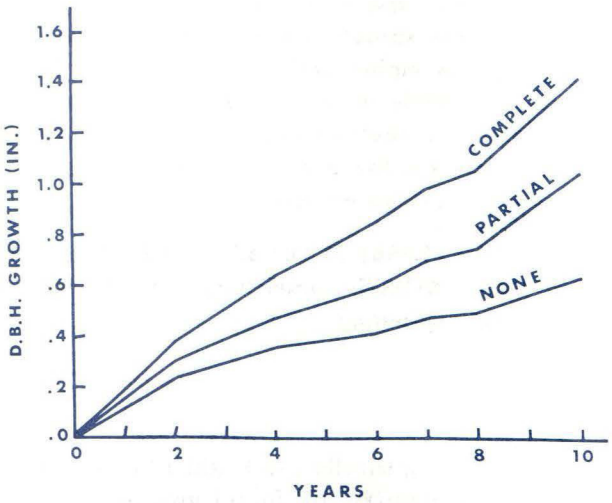

Figure 2. — Cumulative d.b.h. growth per tree during the 10-year study in relation to degree of overstory release.

[1] *Growth trends during the first 4 years were previously reported in: Clark, F. Bryan. Pole-sized black walnut respond quickly to crown release. J. Forest.* 65:406-408. 1967.

was uniformly maintained during the entire 10-year study period. An additional increase in growth rate was observed after the supplementary release in 1968, indicating that the trees had utilized all the growing space provided by the initial release. During the 10 years, the completely released trees grew 1.4 inches in diameter, the partially released trees grew 1.0 inches, and the unreleased trees grew 0.6 inches (table 1). This growth rate is not exceptionally high, but the trees had been severely suppressed for many years and the crowns were small. Even the "complete" release may not have provided enough growing space for maximum development.

Removing understory competition did not have any significant effect on growth during the study period. In fact, trees with understory left intact grew slightly faster than those with the understory removed.

Diameter growth was slower at 17 feet than at breast height. However, there has been no significant change in the form class of the trees. At the end of 4 years, butt log taper appeared to be increased by complete release, but this trend was not maintained through the 10-year period. At the end of the study, the released trees actually had slightly less taper than unreleased trees.

The released trees developed much larger crowns than the unreleased trees, and complete release allowed more crown expansion than partial release. Over the 10-year period, crown expansion in both width and area was over three times as great for the released trees as for the unreleased trees.

Bole sprouts developed on almost one-half of the unreleased trees and on almost two-thirds of the released trees during the study. Sprouts were more numerous on the unreleased trees (16.1 sprouts/tree) than on the partially (12.2 sprouts/tree) and completely released trees (9.2 sprouts/tree). However, the sprouts were much larger on the released trees than on the unreleased trees. Bole sprouting increased sharply during the last 6 years of the study period; after the first 4 years, only one-third of the unreleased trees and about one-half of the released trees had bole sprouts. The number of sprouts per tree also increased during the last 6 years; after 4 years there were only about five sprouts on each unreleased and released tree. The intermediate and suppressed

Table 1. — Effect of crown release on various bole and crown measurements of pole-size black walnut trees

Amount of release	D.b.h.	D.i.b. 17 ft.	Form class	Height	Crown width	Crown area
	Inches	Inches		Feet	Feet	Sq. Ft.
Initial measurements 1959						
None	8.82	6.59	75	66.5	16.2	216
Partial	8.70	6.59	76	66.0	15.9	210
Complete	8.83	6.61	75	66.3	16.0	212
Net increase after 10 years						
None	.63	.35	- 1	4.9	1.4	45
Partial	1.05	.68	- 1	5.2	3.6	114
Complete	1.43	1.06	0	6.3	4.9	161

trees had more sprouts than codominant and dominant trees. Most of the bole sprouts were above the butt log, and there were more on the south side than on the north side of the trees.

MANAGEMENT IMPLICATIONS

Providing adequate crown growing space is perhaps the most important step in managing pole-size black walnut trees. As shown in this study, growth was more than doubled by a relatively light release, and this growth rate was maintained several years after release. Growth response was directly related to crown expansion; thus, any release treatment should be heavy enough to give the crowns plenty of room to grow. The maximum release provided in this study may have been inadequate; leaving more space between tree crowns might have resulted in even faster growth rates.

Both released and unreleased trees produced bole sprouts, so pruning is necessary to produce the greatest amount of clear stemwood. Quality of the trees in the present study was only slightly lowered, because most of the sprouts developed above the butt log. Other studies indicate that after sprouts are pruned, resprouting is minimal if the trees are provided adequate space for rapid crown development. Careful selection of potential crop trees from among the dominants, codominants, and strong intermediates will minimize the sprouting problem. Weak intermediate and suppressed trees are seldom worth releasing, because growth response is poor, crown expansion is limited, and sprouting is abundant. Concentrating management efforts on the best trees with large, vigorous crowns and long, clear boles will provide highest economic returns.

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